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Childbearing and (female) research productivity: a personnel economics perspective on the leaky pipeline

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Abstract Despite the fact that childbearing is time-consuming (i.e., associated with a *negative resource effect*), we descriptively find female researchers with children in business and economics to be more productive than female researchers without children. Hence, female researchers with children either manage to over-compensate the negative resource effect associated with childbearing by working harder (*positive incentive effect*), or only the most productive female researchers decide to go for a career in academia and have children at the same time (*positive self-selection effect*). Our first descriptive evidence on the timing of parenthood among more than 400 researchers in business and economics from Austria, Germany and the German-speaking part of Switzerland hints at the latter being the case: only the most productive female researchers with children dare to self-select (or are selected) into an academic career. Our results have important policy implications when it comes to reducing the "leaky pipeline" in academia.

Keywords Research productivity · Women in academia · Childbearing · Resources · Self-selection

JEL Classification L23 · J14 · J16

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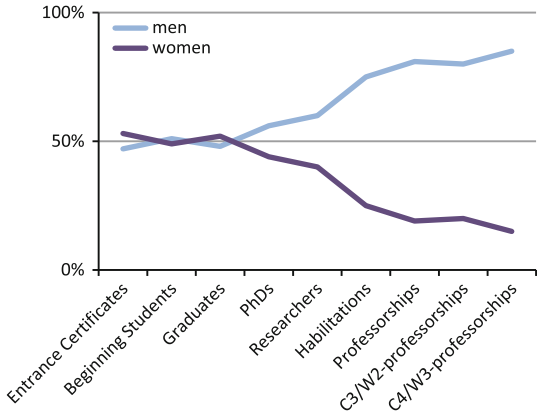

Fig. 1 The "leaky pipeline" in academia in Germany in 2010. Source: own graph based on Expertenkommission Forschung und Innovation (2013: 109)

1 Introduction

The labor force participation of women in Western countries has heavily increased over the past few decades. However, the percentage of women in higher ranked positions did not increase at the same pace. This so-called "leaky pipeline" can also be observed in academia (see Fig. 1): while in Germany in 2010, 52 % of university graduates and 42 % of researchers who obtained a doctorate were female, only 14 % of full professors (C4/W3) were female (see Expertenkommission Forschung und Innovation 2013: 109).

One reason for this leaky pipeline is that a woman's decision to advance her career within or outside academia is influenced by the apparent trade-off between family responsibilities and career orientation. Several studies show that motherhood has an adverse impact on labor supply (see Paull 2008; Xie 1997; Shauman and Xie 1996; Blau and Robins 1988), mobility (see Shauman and Xie 1996), wages (see e.g., Miller 2011; Waldvogel 1997) and career orientation (see Brannen 1989). The fact that career paths in academia require comparatively much flexibility might explain why many female researchers remain childless (see Buber et al. 2011; Mason and Goulden 2004; Perna 2001; Finkel and Olswang 1996).

Existing studies investigating into the relationship between parenthood and research productivity are inconclusive: while e.g., Sax et al. (2002); Cole and Zuckerman (1991) and Hamovitch and Morgenstern (1977) find childbearing not to be related to the number of publications, Stack (2004); Kyvik and Teigen (1996) and Kyvik (1990) find research productivity for female researchers with young children to be significantly lower than for other researchers. To the contrary, Barbezart (2006) and Bellas and Toutkoushian (1999) find researchers with children to be more productive than those without children, and Kyvik and Teigen (1996) identify male researchers with more than two children to publish most.

In our paper, we attempt to shed more light on the relation between parenthood and research productivity from a personnel economics perspective. In particular we do not only study the relation between research productivity and *if* researchers have children, but also the relation between research productivity and *when* researchers have children. While we are not yet in a position to identify causality, our results

might still be of interest in that we detect a somewhat counterintuitive positive relationship between motherhood and research productivity for female researchers while we find no relation between having children and research productivity for male researchers. Concerning the timing of parenthood, for female researchers we find that giving birth in a later career stage (after tenure) is related to a higher research productivity whereas we find, again, no relation for male researchers. We conclude, that either there are positive (incentive) effects of childbearing for female researchers, or, more likely, there is a positive process of self-selection where only the more productive female researchers decide to become mothers.[1]

The remainder of the paper is structured as follows. In Sect. 2 we review the literature and unfold our theoretical argumentation. Section 3 describes our data, variables and methods. In Sect. 4, we present our findings. Section 5 concludes with first policy implications.

2 Literature and theory

2.1 The "If": the relation between parenthood and research productivity

From a personnel economics perspective, there might be very different effects concerning the "if" of parenthood and its relation to research productivity: on the one hand, having a child will reduce the time that can be spent on research (negative resource effect) leading to a lower research productivity. On the other hand, having children might increase researchers' incentives to work even harder in order to be able to economically care for the children (positive incentive effect). Further, there might also be self-selection at work—however, again, the direction is unclear. While it might be the case that the less productive researchers have children with a higher probability (negative self-selection effect), it might also be the case that the more productive researchers are the ones that have children (positive self-selection effect). In what follows, we briefly elaborate on each of these effects and discuss whether and why these might be different for male and female researchers.

Resource effect: Raising children is time-consuming and substantially reduces the time budget that can be used for research. Further, if researchers temporarily leave their job and stay at home, they might also lose part of their human and/or social capital needed to go on with their research career and successfully publish their work. While this latter effect might not be "dramatic" with women in academia typically only leaving their jobs for a rather short period of time around childbirth (see Ward and Wolf-Wendel 2004), having to care for a child will undoubtedly affect the amount of time available for research. As a result, raising children might be associated with a lower publication output. While in theory this negative resource effect could apply to mothers and fathers alike, empirical

[1] An alternative explanation might be that appointment committees in fact use higher hurdles for female researchers with children than for those without. While we do not rule out that occasionally such discriminatory hiring processes may exist, we expect them not to be widespread and hence conclude that if we observe positive productivity differences, these will be the results of a positive self-selection effect.

results on the division of labor within households show that mothers typically invest more time in child raising and household activities than fathers (see e.g., Findeisen 2011; Sayer 2005; Becker 1985). Hence, we expect to observe the negative relation between raising children and publication output to be more pronounced for women and substantially less pronounced for men. Rather, for male researchers, having children might result in their wives staying at home (at least temporarily), which would then even relieve the fathers from household jobs they would have contributed to otherwise. As a result, having children may in fact be even productivity enhancing for male researchers from a resource perspective—if it triggers traditional models of labor division in the household. The above cited empirical studies that find female researchers with young children to have a significantly lower research productivity (see Stack 2004; Kyvik and Teigen 1996; Kyvik 1990) and that find male researchers with children to be the most productive (see Kyvik and Teigen 1996) is compatible with this argumentation.

Incentive effect: If a female researcher decides to become a mother and still advance her academic career, having children might also result in being even more determined to succeed in academia in order to be able to ensure a sufficient and reliable income stream to care for their children. Further, having to combine an academic career and family might actually help female researchers to put their academic career into perspective and undertake their research in a more efficient way (see Ward and Wolf-Wendel 2004; Ropers-Huilman 2000). Comparable arguments apply to male researchers: For them, becoming a father might also be associated with a positive incentive effect and a more efficient way to do their research—especially in those cases where their spouse decides to become a full time mother and does no longer contribute to the household income such that the fathers have a maximum incentive to be productive in order to be able to care for their family. Empirical studies that find researchers with children to be more productive than those without children (see Barbezart 2006; Bellas and Toutkoushian 1999) and that identify fathers to be most productive (see Kyvik and Teigen 1996) are well in line with this supposition.

Self-selection effects: As parenthood is clearly endogenous, a positive or negative relation between parenthood and research productivity might also be the result of a process of self-selection where either the more productive researchers decide to become parents (positive self-selection effect) or the less productive researchers decide to become parents (negative self-selection effect). A positive self-selection effect will be observed if women in academia knowingly decide on having both, a career and a family, and only those who are confident to have enough capacity to cope with both go for the dual burden. All others decide to go for either kids and leave academia (then they are no longer in the sample of researchers) or for their career (then they remain in the sample of researchers but don't have children). As a result, the researchers in the sample who combine kids and career are the ones with above average productivity. A negative selection effect would result if women who—over the course of their career—realized that they are only mildly successful in academia decided to have kids in search of an alternative role that makes up for not being among the most successful researchers.

2.2 The "When": is there a relation between the timing of parenthood and research productivity?

Life-course theory: Concerning the "when" of parenthood and its relation to research productivity, the so-called life-course theory (Elder 1975) might give an indication. According to Elder (1975), an individual's life course is comprised of "interlocking role cycles" such as work, marriage and parenthood. The concept of multiple, interlocking role sequences or cycles applies to situations characterized by a rapid succession of transitions with the birth of the first child representing one example for such a succession of transitions. As Elder and Rockwell (1979: 3) argue, the successful management of resources and squeezes is strongly related to the scheduling of events and obligations. The economic pressure of early childbearing is one example for the adaptive problems that might arise from an asynchrony between resources and demands. While life course theory applies for parents in all occupations, it appears to be particularly suitable for parents who find themselves on a tenure track in academia. In Germany, researchers in economics and business administration e.g., on average get tenure at the age of 38 (see Schulze et al. 2008); i.e., for female researchers "the tenure clock" ticks at approximately the same pace as the "biological clock". Empirically, Elder and Rockwell (1979) analyzed the relation between age at first birth and career position. They find variations in mother's age at first birth to be associated with considerable differences in the career position of parents. Late childbearing apparently offers a number of socioeconomic advantages: The later childbearing occurs, the more the fathers and mothers were able to accumulate material resources and augment their income. Further recent studies support the argument that the timing of the first birth has an effect on income: Taniguchi (1999) and Ellwood et al. (2004) both find a wage penalty for early child bearers. Likewise, Kind and Kleibrink (2012) find a positive causal income effect of delaying the birth of the first child for both, mothers and fathers. Miller (2011) shows that especially the highly educated women experience a decrease in income from early childbearing and substantial increases in earnings for delaying childbirth. To conclude, both, life course theory and the available empirical evidence on income effects of childbirth, suggest that—if income is a general indicator of career success and productivity—there might be a positive relation between delaying the birth of the first child and research productivity, for women as well as for men.[2]

Resource effect: Similarly, also from a personnel economics perspective, a positive relation between delaying the birth of the first child and research productivity might also be the result of the resource effect. Arguably, the costs of career interruptions are highest for women who are not yet tenured and who yet have to publish in order to make their career. As a result, also from the perspective of the resource effect, becoming a mother at a later point in time will be

[2] However, there is evidence—at least outside academia—that wages do not only reflect productivity differences but may also reflect differences in social norms—particularly when comparing wages of males and females as shown by Janssen et al. (2013). But of course, a large part of descriptive differences in the gender wage gap is due to differences in labor attachment, in career choices or in working time patterns as shown in an overview for example by Kolesnikova and Liu (2011).

advantageous as compared to a situation of early childbirth. Further, as Ishii-Kuntz and Coltrane (1992) have shown, better educated women who substantially contribute to family income, have a higher propensity to equally share the housework with their partners. Even though mothers on average tend to invest comparatively more in child raising activities than fathers, it should nevertheless be easier for a female researcher to keep determined in her academic career if her career orientated role formation is already established. To the contrary, if child birth happens to be early in the academic career, a woman's career orientation may be suppressed (see Taniguchi 1999; Ishii-Kuntz and Coltrane 1992).

Incentive effect: Concerning incentive effects, these should in general be stronger in earlier career stages, i.e., before tenure (see e.g., Backes-Gellner and Schlinghoff 2010; Schlinghoff 2001) i.e., if parenthood increases incentives to publish and be productive because the researcher feels the need to earn a living for his/her family, this should rather make an effect in earlier career stages (and not when the researcher is already tenured). Hence, from the perspective of the incentive effect, it is early childbirth that might positively affect research productivity, not late childbirth. The results by Smith et al. (2013) that provide empirical evidence for higher promotion probability into a CEO position for women who gave first birth at a *young* age would also fit into this picture.

Self-selection effects: Also with respect to the timing of childbirth, there might be a process of self-selection where arguably the more productive and career-oriented researchers decide to become parents at a later stage of their academic career. Accordingly, a later childbirth might indicate a stronger career "taste" (Blackburn et al. 1993).

3 Data, variables and methods

Our study is based on a unique data set of 419 researchers in business and economics from Austria, Germany and the German-speaking part of Switzerland. The data set contains information on researchers' journal publication output until 2010, researchers' age, gender and field ("business administration" vs. "economics"). While the data on publication output and demographics are collected on a regular basis via the online portal *Forschungsmonitoring* initialized by the German Economic Association *Verein für Socialpolitik* covering more than 4,000 researchers in business administration and economics in the German speaking countries at different career stages, we gathered the information on the family situation (having children: if and when, and living in a partnership: yes or no) via an additionally conducted survey of the researchers in the data set in 2010.

As *dependent variable* we use researchers' annual publication output in refereed journals as an indicator of research productivity. To account for a potentially differing quality of journal publications, we use the 'Handelsblatt' Journal ranking as one of the most visible, though not uncontroversial, journal rankings for the researchers in the data set (see Krapf (2011) for the details). To measure publication productivity, we divide a researcher's quality- and coauthor-adjusted journal publication output as measured in 'Handelsblatt' points by his or her 'career age',

i.e., by the number of years since the researcher published his or her first journal article (see Muschallik and Pull 2012).[3] For the researchers in our data set, the average publication productivity amounts to 0.14 publication points per year where one single-authored article in "The Journal of Business Economics (*Zeitschrift für Betriebswirtschaft*)" is ascribed 0.20 publication points.

Our central *explanatory variable* in our first regression is the dummy variable "children" (1 = the researcher has at least one child, 0 = otherwise). 60 % of the researchers in our data base have children, 40 % do not (yet) have children (51 % among the female researchers, and 38 % among the male researchers). In our second regression, we look at the timing of the first birth and distinguish between researchers who became a parent before obtaining their PhD, with or after obtaining their PhD and with or after getting tenure. 24 % of the researchers in our sample got their first child before obtaining their PhD (28 % of the females and 23 % of the males), 63 % became a parent with or after obtaining their PhD (64 % of the females and 63 % of the males), and 13 % got their first child with or after getting tenure (8 % of the females and 14 % of the males).

As a first important *control variable* we include the researcher's gender. 18 % of researchers in our data set are female, 82 % are male. Besides controlling for gender, we also estimate our regressions separately for male and female researchers in order to detect potential differences in how the explanatory and control variables relate to research productivity. Further, we include whether the researcher lives alone or in a partnership in an attempt to grasp a researcher's family situation and potential support structure. 81 % of the researchers in our data set live in a partnership. Furthermore, we control for age. Mean age is 42, ranging from 28 years of age until 70. As further controls, we include field of research ("business administration" vs. "economics"), research abroad, and mentoring participation.[4] Table 1 displays the means, standard deviations and correlations of all variables. All variance inflation factors (VIF) were below 1.32; i.e., there is no multicollinearity problem.

4 Results

4.1 The "If": the relation between parenthood and research productivity

The relation between parenthood and research productivity is analyzed using an ordinary least squares (OLS) estimator with robust standard errors (Table 2). As a result of missing variables we have $n = 352$ cases altogether, 61 female researchers and 291 male researchers.

[3] As a robustness check we also measured career age by the number of years since obtaining the PhD (see e.g., Fiedler et al. 2008; Chlosta et al. 2010) and find our results to be robust to this alteration.

[4] Since Breuninger (2012), working on the same data set, detected "research abroad" (defined as a research stay of at least one month at a foreign research institution) to be related to research productivity, we also include it as a control variable. 71 % of the researchers in our data set stayed at a foreign research institution for at least one month. With the same reasoning, we further control for a researcher's attendance of a formal mentoring program, since Muschallik and Pull (2012) have found publication productivity to differ between researchers who attended or still attend a formal mentoring program. Five percent of researchers in our dataset attended or still attend a formal mentoring program.

Table 1 Variables: means, standard deviations and correlations

Variables	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)
(1) Research productivity	0.142	0.131	1					
(2) Children (dummy, 1 = yes)	0.600	0.491	0.025	1				
(3) Female (dummy, 1 = yes)	0.184	0.388	−0.134***	−0.108**	1			
(4) Partnership (dummy, 1 = yes)	0.811	0.392	0.033	0.420***	−0.090*	1		
(5) Age	43	9.393	−0.133***	0.347***	−0.244***	0.181***	1	
(6) Bus.Adm. (dummy, 1 = yes)	0.594	0.492	−0.024	−0.014	0.041	0.043	−0.066	1
(7) Research abroad (dummy, 1 = yes)	0.706	0.456	0.200***	0.052	−0.093*	0.128**	0.059	−0.111**
(8) Formal mentoring (dummy, 1 = yes)	0.053	0.225	0.057	−0.003	0.219***	0.004	−0.109**	0.041

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2 The "if": the relation between parenthood and research productivity (OLS)

	OLS Research productivity		
	All	Women	Men
Children (dummy, 1 = children)	0.023 (0.014)	**0.104*** (0.056)	0.011 (0.016)
Female (dummy, 1 = yes)	−0.062*** (0.0184)		
Partnership (dummy, 1 = yes)	−0.006 (0.021)	−0.030 (0.027)	0.002 (0.027)
Age	−0.003*** (0.001)	−0.007 (0.004)	−0.003*** (0.001)
Bus.Adm. (dummy, 1 = yes)	−0.004 (0.014)	0.004 (0.029)	−0.004 (0.015)
Research abroad (dummy, 1 = yes)	0.050*** (0.014)	0.071** (0.027)	0.044** (0.017)
Formal mentoring (dummy, 1 = yes)	0.044* (0.026)	−0.000 (0.036)	0.077** (0.039)
Constant	0.257*** (0.041)	0.306** (0.151)	0.254*** (0.044)
R^2	0.096	0.191	0.076
No. of observations	352	61	291

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

When we run the model for all researchers in our data base (males and females), parenthood does not seem to be related to research productivity. The same is true, if we only look at the male researchers i.e., positive and negative effects associated with parenthood apparently outweigh one another for males. However, when the sample is restricted to female researchers, having children is associated with a *higher* research productivity i.e., for female researchers, the negative resource effects associated with having children are apparently overcompensated by a positive incentive effect or a positive self-selection effect where the most productive female researchers get children—or a mix of both. Our result is robust with respect to our measure of career age: when we alternatively measure career age by the number of years since obtaining the doctorate instead of years since first publication, we find the very same results.

Concerning the controls, we find that female researchers apparently have a lower research productivity as measured in publication points per career year. This is compatible with the results obtained by e.g., Fox and Faver (1985), Bellas and Toutkoushian (1999) or Stack (2004). Partnership is not significantly related to research productivity, neither for the males nor for the females. Age is negatively related to research productivity, i.e., the younger researchers have a higher research productivity measured in publication points per career year. The field of research ("business administration" vs. "economics") does not seem to make a difference. As in previous research with the same data set, stays abroad and formal mentoring are positively related to research productivity. While we cannot exclude reverse causality at this point, previous work employing matching techniques finds evidence for stays abroad (see Breuninger 2012) and formal mentoring (see Muschallik and Pull 2012) to positively influence research productivity.

Figure 2 displays the research productivity of female researchers in the time period five years before giving birth to their first child and five years afterwards. As can be seen, research productivity actually peaks at birth. Taking into account the length of publication cycles, the graph hints at female researchers deciding to

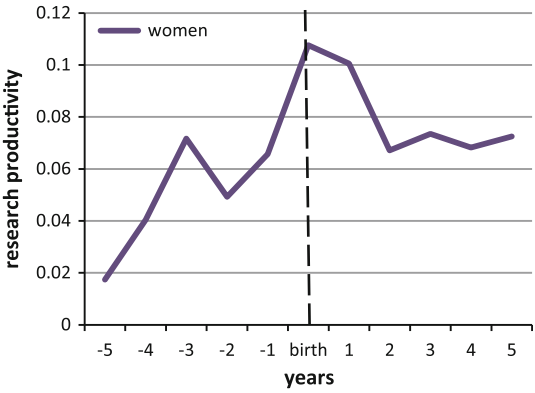

Fig. 2 Research productivity of female researchers before giving birth and afterwards. Source: own data

become pregnant only after they managed to successfully publish their work and be up for tenure. This clearly hints at a process of positive self-selection where only females who are highly productive in the first place decide to have a child while at the same time striving for an academic career. Further, the fact that research productivity goes down after birth, hints at the presence of a negative resource effect that only the very productive researchers manage to overcompensate.

4.2 The "When": is there a relation between the timing of parenthood and research productivity?

In a next step we look at the timing of parenthood and distinguish between (a) researchers who get their first child before the doctorate, (b) researchers who get their first child in the year of their doctorate or later, but before they get tenure, and (c) researchers who get their first child in the year they get tenure or later. Researchers without children constitute the reference group.

Again, we use an OLS estimator with robust standard errors (Table 3) and apply the same control variables as before. The dependent variable again is average annual research output, i.e., research productivity, measured as a researcher's publication output in refereed journals (in terms of 'Handelsblatt' points) divided by career age. The number of cases is slightly reduced because of missing timing information. As our results for the controls are the same as before, in what follows we only report on the results for the timing variable.

For the full sample as well as for the subgroup of male researchers, we find the timing of the first birth not to be related with research productivity. For the subgroup of female researchers we find that female researchers that gave birth to their first child *after* getting tenured have a higher research productivity than researchers without children. For female researchers that gave birth to their first child *before* getting tenure there is no significant difference in research productivity as compared to the childless female researchers. As the positive incentive effects associated with parenthood should be larger in earlier career phases, the fact that only the later births are positively related to research productivity hints at a process of positive self-selection to be at work: the more productive female researchers are confident to manage both: their academic career *and* motherhood.

Table 3 The "when": the relation between parenthood in different career phases and research productivity (OLS)

	OLS Research productivity		
	All	Women	Men
Birth of first child before doctorate[a]	0.002 (0.018)	0.074 (0.048)	−0.011 (0.019)
Birth of first child with/after doctorate[a]	0.024 (0.016)	0.103 (0.064)	0.012 (0.018)
Birth of first child with/after tenure[a]	0.039 (0.024)	**0.183**** (0.077)	0.022 (0.026)
Female (dummy, 1 = yes)	−0.059*** (0.018)		
Partnership (dummy, 1 = yes)	−0.005 (0.021)	−0.037 (0.027)	0.027 (0.028)
Age	−0.003*** (0.001)	−0.007 (0.004)	−0.003*** (0.001)
Bus.Adm. (dummy, 1 = yes)	−0.003 (0.013)	−0.006 (0.029)	−0.002 (0.016)
Research abroad (dummy, 1 = yes)	0.046*** (0.015)	0.061** (0.027)	0.040** (0.018)
Formal mentoring (dummy, 1 = yes)	0.048* (0.027)	0.000 (0.037)	0.081** (0.041)
Constant	0.245*** (0.042)	0.310** (0.147)	0.242*** (0.046)
R^2	0.099	0.222	0.078
No. of observations	343	60	283

Robust standard errors in parentheses

[a] reference group: researchers without children

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Further, if the ones that decide to go for their career and have children at the same time are really the more productive ones, they are also likely to receive tenure earlier because they have a good enough track-record at an earlier point in time, which makes it more likely that their children are born after they got tenure. This, too, would explain why mothers who give birth to their first child after tenure are more productive than others: it would again be a positive self-selection effect. Lastly, our result is also compatible with a story of risk minimization of academic mothers, i.e., female researchers that decide to have children attempt to find the "least risky" moment to do so—i.e., the moment where a number of papers have been accepted for publication. Since such a risk minimization strategy supports our argument that female researchers with children have a strong preference for being successful in order to guarantee a sufficient and stable income to take good economic care for their children in the long term, we do not try to further empirically disentangle the two explanations.

As a robustness check for our results on the timing of childbirth, we also included "tenure" and "no. of children" and find our results to be robust to this alteration. Also, measuring career age as the number of years since obtaining the doctorate does not change our central results.

5 Concluding remarks

In descriptive analyses for researchers in business and economics departments, we find female researchers with children to be more productive than female researchers without children—although a *negative resource effect* would suggest that the productivity of females is reduced as a result of childbearing. We argue that the

positive productivity differential can be explained by a *positive incentive* and/or a *positive self-selection effect*. Our empirical results hint at a strong positive (self) selection where only female researchers with a far above average productivity (the high-performers) dare to go for a career in academia and have children at the same time—and/or where only these exceptionally productive female researchers are able to successfully pass the many selection steps built into the system.

Thus, with tenure and biological clock ticking at the same time, our results indicate that in comparison to male researchers a substantial number of equally talented and equally high achieving female researchers either "get lost" on their way (and leave academia for another job)—just because they wanted to have children and were afraid not to be able to manage the dual burden—or they remain childless (which is no better from a societal perspective given the demographic problems being faced in many developed countries). To the contrary, male researchers typically do not face the same tradeoff: in most cases those who want to have children rely on their wives in case the dual burden comes too hard on them. Thus, for males, the potential of talented researchers is much better exploited than for females—leading to the well-known "leaky pipeline". While our results are rather descriptive and should hence be interpreted with caution they are in accordance with the preliminary results of a recent working paper by Krapf et al. (2013) who work with a different data set and different methods. This makes us confident that our results are more than mere statistical artifacts, and it encourages us to formulate the following policy implications.

If a country (or a single university) does not want to waste the innovative potential of half of its population, appropriate steps need to be taken to avoid that among female graduates mainly the very high and top performers dare to stay in or are selected into academia—while for the males the whole distribution of talents is exploited. Ideally, policy measures should consist of two parts: *First*, measures should be taken to reduce the burden of childcare for female researchers (i.e., reduce the negative resource effect), e.g., by ensuring a sufficient supply of day-care centers for toddlers, kindergardeners or school-kids within the university context. This will also help male researchers who want to take their share in child caring activities and hence in the long run may also generate an additional support for female researchers with partners in academia who want to become a mother. And, of course, a sufficient supply of childcare will also help the female top performers—who even in today's world decide to stay in academia—to further improve their research productivity. *Second*, measures should be taken that clearly signal all female researchers that they will not be disadvantaged if they decide to go for kids: e.g., by being able to stop the tenure clock or by installing an explicit handicap-system in appointment tournaments. Stopping the tenure clock would imply that tenure-track faculty members (e.g., tenure-track-'Junior Professors or Assistant Professors' in the German system) can delay their tenure review for family reasons if they think their research productivity is negatively affected.[5] A handicap-system would e.g., mean that

[5] Flaherty et al. (2013), e.g., show that the research output at the time of the tenure review of faculty members who stopped their tenure clock is not significantly different from non-users and they conclude that "stopping the tenure clock polices" are effective for leveling out the playing field for the tenure decision. However, they also find that faculty members stopping the clock suffer from lower incomes as stopping the tenure clock might signal a lower commitment.

female researchers with children need a lower number of publications to get tenure or to succeed in an appointment tournament than males or females without children.[6] Both, the ability to stop the tenure clock and the specific features of a handicap system could be especially tailored to keep all talented and not only the very top performing female researchers in academia and allow them to have children at the same time (as is the case for the male researchers over the whole talent distribution). Only very strong signals for female researchers (see Niederle et al. 2013, for a similar point concerning quotas) are likely to weaken the strong self-selection effect. By leveling out the playing field for up-coming female researchers with and without kids hopefully more talented female researchers will decide to go for an academic career and for kids, which in turn will help to reduce the leaky pipeline effect.

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[6] Interestingly, a handicap-system favoring female researchers with children would not reduce incentives for the others, but would in fact restore incentives for all researchers by reducing contestant heterogeneity—as has been shown theoretically for appointment tournaments (see Chlosta and Pull 2010) and empirically for tournaments in a business context (see Backes-Gellner and Pull 2013).

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